

THE INFLUENCE OF CERTAIN OCULAR DEFECTS IN CAUSING HEADACHE.

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The influence of abnormal conditions in the organs of vision in causing headache has long been recognized, but it cannot even now be said that the nature of that influence in all its bearings is fully understood. The term *eye strain* is, indeed, applicable to a very complex condition, in which anatomical, mechanical, muscular and nervous influences variously combined each play their part. Whenever there is a deviation from the normal state in any one or more of these particulars, visual disturbance of some sort is likely to result, and with it more or less disturbance of function in other parts or organs.

In the eyes themselves, such disturbance of function most frequently presents itself to the ophthalmologist in some form of so-called asthenopia. Many cases of this kind are also accompanied with reflex disturbances in parts more or less remote from the eyes, the most important of which, in point of frequency at least, undoubtedly is headache. Headache from this source may attain any degree of severity, from mere discomfort to the most unbearable agony. It may be constant or intermittent, but in any case it is likely, in the long run, to resist every remedial measure until the visual difficulty, whatever it may be, is discovered and suitably corrected. Some experienced ophthalmolo-

gists go so far as to contend that nearly every case of migraine or sick headache is associated with some defect in the visual apparatus ; for my own part, whilst admitting that such an association is of frequent occurrence, I am inclined to think there is a large proportion of these cases not to be accounted for in this way. Others, again, claim that all sorts of nervous disorders, including chorea, epilepsy and insanity, are often due to the same cause ; on this point I am not prepared to express an opinion.

There is, however, among ophthalmologists, and through their labors also, I think, in the general profession, a settled conviction as to the importance of ocular defects in causing headache. On this subject there is, however, but little information to be gained from the ordinary text-books of medicine, though current literature contains much that is well worth careful study.

Every one has heard of remarkable cures of headache by the correction of certain errors of refraction, and there is, perhaps, a widespread notion that ocular defects causing headache only require the adaptation of suitable glasses to remove the trouble. This is quite true of certain cases, the correction of the refractive error may accomplish all that is to be desired. Sufferers from headache during half a lifetime have time and again been cured in a few days by wearing the glasses that have corrected a simple hyperopia. I once saw a student who had reached the third year of his university course, a martyr to headache all the time, and subject to attacks of vomiting if he studied longer than two hours consecutively, so disheartened that he had decided to abandon his university career when he found himself suddenly cured of all his ailments by wearing convex cylindrical lenses of 36 inches focus. Convex sphericals of the same focal distance had been used for some time previously without benefit. Here there was only a simple error of refraction, slight in degree, but giving rise to symptoms that might readily have been mistaken for some serious organic disease. Such a case can, I take it, only be explained by assuming an instability of nerve force which a trivial disturbing element was capable of putting completely out of balance. On the other hand, it is a matter of daily experience to meet with persons whose visual apparatus presents

infinitely greater deviations from the normal without setting up any noticeable mischief.

As a rule, those who suffer considerably from slight ocular defects are neurotic subjects, in whom minor ailments are apt to make more show than serious ones do with those whom nature has endowed with vigorous nerve power. But there are visual abnormalities which even the most vigorous cannot bear up against without suffering, more particularly when any unusual demands are made on the organs of vision, or when from any cause the general health becomes deteriorated. In such persons the true nature of the troubles they experience is exceedingly apt to be overlooked unless the eye symptoms happen to predominate, which by no means always occurs.

I have said the elements which may unite to produce eye strain, though simple in themselves, constitute a complex condition when so combined. Let us consider the most important ones separately, always bearing in mind that several may be combined in the same individual.

First of all come the errors of refraction—myopia, hyperopia and astigmatism. Next we have defective muscular action both of the extrinsic and intrinsic muscles of one or both eyes, in which any one or more of these may be implicated. Lastly, there may be faults in the perceptive organs—that is, of the retinae and their nerve centres. This third division we may leave out of the question, as a consideration of this part of the subject would take us beyond the limits of a short discourse.

It is the physiological demand for binocular vision and for distinct vision that under certain circumstances induces eye strain and consequent headache. We must therefore direct our attention chiefly to the muscular apparatus, any portion of which may be defective in power, or, what amounts to the same thing, the demands made upon it may for various reasons be greater than it can bear.

In hyperopia and in astigmatism the chief demand is for distinct vision, hence the ciliary muscle is liable to be overtaxed, and there will be accommodative asthenopia. In myopia, the muscles of convergence are placed at a disadvantage, and we are more likely to meet with so-called muscular asthenopia.

Both in myopia and hyperopia, as shown by Donders, the acts of accommodation and of convergence, which are essential to binocular vision, become disassociated. It is only in the emmetropic eye that they are arranged to act equally at all distances. This want of harmony between the intrinsic and extrinsic muscles is in itself a fruitful cause of eye strain. As a manifestation of this disassociation, we often meet with the obvious muscular defect called strabismus, usually convergent in hyperopia, and divergent in myopia. In emmetropia, the range of distinct vision, consequently both of accommodation and of convergence, is from infinity up to some near point, say a few inches distance, but in the above mentioned errors of refraction, though there is the equivalent range of distinct vision, it is displaced more or less, backwards from the normal near point in myopia, and forwards in hyperopia. Correction of these errors of refraction acts beneficially in each case by restoring the range of vision to something like its normal position, and, consequently, in re-establishing the association between convergence and accommodation. Correcting glasses also act, in hyperopia, as a direct relief to the ciliary muscle by diminishing the necessity for excessive accommodative efforts, whilst in myopia suitable glasses relieve the necessity for extreme convergence. In astigmatism, the constant effort to obtain distinct vision is particularly irksome, probably because it induces an irregular action of the ciliary muscle, a structure which nature has designed to act uniformly in all its extent, and which, on account of its delicate functions, is endowed with numerous and extraordinarily sensitive nerves. In astigmatism, then, we have to deal with accommodative asthenopia. But when the extrinsic muscles are at fault, the difficulties caused by otherwise uncomplicated errors of refraction cannot always be remedied by glasses that correct the refractive error. There can be no doubt that defects in the extrinsic muscles are met with much more frequently in connection with errors of refraction than in the normal eye, and it is sometimes found that a suitable correction of the refractive error will in time restore muscular equilibrium where this has been defective. Correcting glasses can often be supplemented in their action by combination with prisms in such a position as to relieve the strain

of overworked muscles. Combinations of this sort may have the happiest effect in allaying the visual disabilities of those who suffer from both refractive and muscular errors. There are, however, cases in which a defective action on the part of the extrinsic muscles is the sole cause of the visual difficulty, and I am convinced that a large proportion of those cases in which a careful correction of the refractive error affords little or no relief to the symptoms of eye-strain can be explained by the presence of some defect in the action of the extrinsic muscles, either inherent or the result of long habit—a defect which must be corrected before relief can be obtained by wearing glasses. The following case illustrates this point:—

Mrs. S., aged 37, consulted me in the year 1883 on account of short sight, weak vision, and almost constant headache, troubles which dated back to girlhood, and from which she had never been able to find relief. She was wearing concave spherical glasses for distance only, of 16 inches focus. Under atropine I found M $-1/14$, with myopic astigmatism about $1/60$, vision $\frac{20}{20}$ each, and apparently some weakness of the internal recti, but, as I thought, not enough to call for special attention (at that time I was not in the habit of testing the muscular functions in doubtful cases as carefully as I do now), I ordered —18 to be worn constantly if possible. Three and a half years later—that is, last April—she came to me again complaining that the eyes and head were, if possible, worse than ever. I then found the refraction, corrected under atropine: R., -4.50 D $\bigcirc -0.50$; D ax. 70° ; vision $\frac{20}{30}$. L., -4.50 D $\bigcirc -0.75$; D ax. 100° ; vision $\frac{20}{20}$. With this correction there was a latent divergence at 6 metres distance, $\approx$ pr. 6° , abduction $\approx 15^\circ$, adduction the same. Abduction increased by exercise to 18° and adduction to 25° . Though varying slightly from day to day, repeated examinations substantially confirmed these conditions. There was thus an evident loss of muscular balance in favor of the external recti. This I corrected by a partial tenotomy of the left external rectus carefully regulated to exactly correct the latent divergence. She was directed to continue using the same glasses as before. A month later she came to report the result. There was then perfect muscular balance at 6 metres, abduction 12, adduction

30. From the day of the operation the headache had entirely disappeared.

Insufficiency of the external recti with latent convergence has lately also become a well recognized condition as a cause of asthenopia and its attendant discomforts. This condition is perhaps of less frequent occurrence than the same defect in the internal straight muscles. When discovered, however, it may, if necessary, be remedied by taking from the internal recti their overplus of power, or the relative strength of the externi may be augmented by a carefully regulated advancement of the tendon.

I now come to what I believe will prove to be one of the most important muscular anomalies, for the detection of which and a precise knowledge of the proper measures for its relief we are mainly, if not entirely, indebted to Dr. Geo. T. Stevens of New York. I allude to defective action of the superior and inferior recti. I have recently found this defect to be of more frequent occurrence than I should have anticipated, and it is of extreme importance, not only on account of the visual and other (reflex) disturbances an error of this kind is capable of inducing, but also in its influence on the action of the other ocular muscles. I now consider no test of the muscular functions to be complete unless the condition of the superior and inferior recti is carefully taken into account, because a latent vertical deviation so disturbs the balance of the other muscles that the most misleading results are likely to be obtained if a vertical deviation has been overlooked. The terms suggested by Dr. Stevens to express the various abnormal conditions of the extrinsic ocular muscles seem to me entirely satisfactory, and I now always employ them in my records. Vertical deviation or *hyperphoria* may be combined with any error of refraction, and with lateral deviation in either direction, such as the following case, which is one of compound hyperopic astigmatism, with hyperphoria and exophoria:—

Mrs. F., aged 36, a thin, worn-looking woman, has had pain in the eyes and headache for many years, always aggravated by near work. In Dec. 1883, I found under atropine—

R., + 32 s. $\bigcirc$ —80 c., ax. 135° , $\frac{20}{20}$.

L., + 40 s. $\bigcirc$ +14 c., ax. 130° , $\frac{0}{40}$.

and ordered these for all near work. They afforded some relief,

but the headaches remained as before. She came again in April, 1887, and I found the refraction unchanged. After repeated examinations I found 1° of right hyperphoria and 2° of exophoria, abduction $=9^\circ$, adduction $=16^\circ$. After partial tenotomy of left lower rectus, the hyperphoria was corrected, but the lateral deviation remained unaltered. This was also corrected by partial tenotomy of right external rectus. On June 14th there was exophoria 1° , abduction 6° , adduction 23° , and freedom from headache. On June 25th there was exophoria $=2^\circ$ and some headache after prolonged use of the eyes. The remaining exophoria will probably require a repetition of the tenotomy. There is evidently still a considerable degree of latent excess of strength in the externi.

In another case, a gentleman 45 years of age, there was : R. H. $=0.75$ D $\frac{20}{20}$. L. H. $=4$ D. $\bigcirc +2$ D. c., ax. 110, $\frac{20}{30}+$. With frequent headache and the head feeling so badly he was in great anxiety, fearing the head symptoms indicated organic disease of the brain. Here the correction of $1\frac{1}{2}^\circ$ right hyperphoria by partial division of the left inferior rectus and the correction of the error of refraction by glasses relieved the head completely.

The same error of muscular balance will undoubtedly cause distressing symptoms where there is no error of refraction or one so slight that it will not account for the symptoms. I have recently seen a marked instance of this kind, and will here give another in which the error of refraction was trivial, but the patient a great sufferer from headache and weak vision ; he also had a worn, distressed look which one often meets with in cases of eye strain :

C. A., aged 29, has had weak vision since his school-days, and suffered almost constantly from headache. In 1880 I treated him for an anterior choroiditis of the left eye, from which he made a perfect recovery, but I did not succeed in relieving his asthenopia. Last June I again had an opportunity to examine the eyes, and found, under atropine : R. $+0.75$ D s. $\frac{20}{20}$. L. $+0.75$ D s. $\bigcirc 0.75$ D c., $90^\circ \frac{20}{20}$. There was slight insufficiency of the internal recti, with exophoria 1° and left hyperphoria 1° . A correction of the latter gave immediate freedom from headache, and was soon followed by a marked improvement in his general health.

There can be no doubt that visual imperfections which call for a constant and abnormal expenditure of nerve force, such as must necessarily be the case where there is a latent deviation of the optic axis in any direction, is not only a frequent cause of morbid conditions in the eyes themselves, such as conjunctivitis, blepharitis and keratitis, perhaps, too, of deeper seated inflammatory affections of these organs, but also of headache, migraine, neuralgia and other nervous disorders. That they cause deterioration in the general health almost goes without saying.

Every subject of such visual defects as these is handicapped or over-weighted to just such an extent that he is liable to break down before the finish. In the cases I have quoted I have not, for obvious reasons, gone fully into details, but enough has been said to show their bearing on a subject which seems to me to merit more attention than hitherto has been bestowed upon it even by those who have to do exclusively with ophthalmic surgery; and, I am convinced, the facts I have endeavored to bring forward may be used as a key to unlock the hidden secret of many obscure and troublesome cases that would otherwise stand as an opprobrium to medical art, bidding defiance to all its resources.